

# **COMPOSITES AFFORDABILITY INITIATIVE COST ANALYSIS TOOL (CAICAT)**

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## **PROBLEM / OBJECTIVE**

The Composite Affordability Initiative (CAI) was established in 1998 to dramatically reduce the cost of composites structures essential to high-performance aircraft. One of the early findings of the CAI cost team was that the weight-based models then in use did not have the ability to accurately and credibly estimate the cost of composite structures manufactured with emerging technologies. Therefore, any cost savings derived from technology advancements were difficult to accurately quantify. The objective of this project was to fill this void by creating a cost model that would be accepted across the aerospace industry as well as by the Department of Defense (DoD).

## **APPROACH / BUSINESS STRATEGY**

The CAI cost team surveyed the current state of the art and identified the best software to meet its needs. This allowed the team to leverage commercial software developments. The direct cost model selected by the team was produced by Galorath. Galorath in collaboration with the CAI cost team developed specific modules that described the process steps, their variables, and related costs. The Aerospace industry supplied cost data required for the modules. These process modules added to the current set that was included in the software and included state of the art and emerging composite fabrication/assembly processes. These processes included hand lay-up, vacuum assisted resin transfer molding, fiber placement, co-resin transfer molding, Z-pinning, etc., as well as some state-of-the-art metal processes, such as high speed machining. The indirect cost model was a commercial product of MCR, and the factory simulation model was an AutoSim product (these were also customized to meet CAI cost team needs). The Navy developed the Operation and Support module while the CAI cost team developed the RDT & E module.

## **ACCOMPLISHMENTS / PAYOFF**

This effort has led to the successful development and demonstration of a cost analysis tool (CAICAT) that enables increased cost reductions by verifying the most affordable structural concepts earlier in the design phase and with greater dependability than previously possible. The tool captures costs related to the development and fabrication of composite aircraft structures including direct costs; indirect costs; research, development, test & engineering (RDT&E) costs; and operational & support costs (O&S). For example, direct costs include fabrication/assembly labor and materials; indirect costs include floor space and cycle time. The improvement in cost analysis is accomplished by identifying the costs related to each process step and adding these costs together as opposed to assuming the cost based on the weight of a structure (weight-based parametric models).

CAICAT offers the aerospace industry the opportunity to improve the decisions made during the preliminary design phase by enabling the review of 10 times as many options. If the preliminary design phase needs to be compressed, CAICAT allows the design team to conduct a set number of trades in 1/10th the time compared to traditional methods. The direct cost model was extensively validated. The costs for a range of components from small parts to full-scale assemblies were assessed with CAICAT and compared with the actual production costs. Part/assembly cost information was supplied by the aerospace industry for validation. More than 74 percent of the structures and assemblies evaluated were within 10 percent of actual costs, and over a third were within two percent! The real success of CAICAT is demonstrated by the fact that the CAI aerospace participants are using it extensively for both DoD and commercial applications.

## ***Implementation***

CAICAT has been used for trade studies on the Joint Strike Fighter (F-35); Boeing 767; F-16; F-22; F-18; DD(X); RAH-66; V-22; Pegasus; UCAV; and GE90-115, F110-132, CF34, ATEGG, and JTDE engines.

## **TIMELINE/MILESTONES**

Start Date: January 1998

End Date: June 2001

## **FUNDING**

Air Force-Navy Jointly Funded Project

Total Government Cost: \$2.1 M

Industry Cost Share: \$2.1 M

## **PARTICIPANTS**

The Boeing Company

Lockheed Martin

Northrop Grumman

Navy ManTech Program Office

Joint Strike Fighter Program Office

Naval Air Systems Command (Materials and Structures)

US Air Force Research Laboratory's Materials and Manufacturing Directorate

US Air Force Air Vehicles Directorate

## **POINTS OF CONTACT**

### **Navy ManTech**

Office of Naval Research

Ms. Jennifer A. Koury (Code 361)

(703) 696-0344

[kouryj@onr.navy.mil](mailto:kouryj@onr.navy.mil)

### **Weapons System Program Office**

Joint Strike Fighter Program Office

David Cadman (Airframe IPT Lead)

(703) 601-5570

[david.cadman@jsf.mil](mailto:david.cadman@jsf.mil)

Generic - Fighter Aircraft

### **Performing Activity**

Northrop Grumman

Boeing Seattle